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PROGRESS - REPORT

August 1, 1952 to September 30, 1952

Contract No: N7 onr-35805

Division of Engineering  
Brown - University  
Providence, Rhode Island

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OFFICE OF NAVAL RESEARCH

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PROGRESS REPORT: August 1, 1952 to September 30, 1952  
CONTRACT NUMBER: N7-onr-35805

1. Upper Transonic Regime

The calibration of the test section containing three dimensionally shaped upper and lower walls as suggested in our report WT-6 has been completed. For a mach number range from .8 to 1.1 the velocity distributions are satisfactory. That means that the damping characteristics of these walls are sufficient. For mach numbers higher than that it is planned to install a flexible nozzle, so as to reduce the suction requirements of the test section. Considerable time has been spent on improving the re-entry flow downstream of the slots. In conjunction with that a one dimensional analysis has been carried out to determine the amounts of suction obtainable with given geometrical arrangements. The method that finally has been arrived at consists of having adjustable flaps downstream of the slots. It was found that it is extremely difficult to obtain stable flow, that is, flow with only slight fluctuations near mach number unity. The stability of the flow, however, could be improved considerably by choking the flow downstream of the re-entry flaps. The problem of flow stability is incidentally also present in the conventional closed test section tunnels.

The choking of the flow is presently done by lowering the upper wall of the tunnel behind the test section. However, since this yields an unsymmetrical flow distribution at the location of the re-entry flaps, an adjustable center body is being prepared to achieve the same effect. This center body will also serve as a supersonic diffuser at higher mach numbers.

When a body of revolution was placed in this slotted test section it was found that some of the disturbances were reflected in the sense of an open jet. These results, based only on Schlieren pictures as yet, would indicate that the reflection properties of the wall are good. One cannot expect to cancel all reflections completely since this would require a wall which is built especially for a given flow pattern, which in turn would have to be known before one could design the wall.

As the next step it is planned to investigate the reflections of the disturbances caused by an essentially two dimensional model, a wing.

## 2. Perforated Walls

The boundary layer characteristic of a variety of different perforated walls was investigated in the jet of a low speed tunnel. It was found that it is extremely difficult to correlate the results obtained in these tests. Also extreme care and accuracy were necessary to obtain reasonable looking curves. The arrangement finally arrived at consisted of a jet which was open on one side in order to secure constant pressure along the test section and of a knife edge which cuts off the boundary layer before the flow reaches the perforated wall. It appears that suction amounts required to operate such walls (in order to compensate for the displacement of the mixing or boundary layer region) check reasonably with those predicted by a simplified theory analogous to the theory of free jet mixing. After further investigation, mainly about the influence of the presence of a body in the jet, these results will be assembled in a technical report.

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